

ferromagnetic layer at zero applied magnetic field, the second ferromagnetic layer comprising first and second ferromagnetic films antiferromagnetically coupled to one another and an antiferromagnetically coupling film located between and in contact with the first and second ferromagnetic films for coupling the first and second ferromagnetic films together antiferromagnetically so that their magnetizations are aligned antiparallel with one another and remain antiparallel in the presence of an applied magnetic field, the magnetization of the first ferromagnetic layer freely rotating in signal magnetic field. The element further comprises a pair of electrodes coupled to the magnetoresistance effect film and having respective inner edges; and a pair of longitudinal biasing layers for providing bias magnetic fields to the first ferromagnetic layer in parallel with a longitudinal direction of the first ferromagnetic layer and having respective inner edges, wherein the inner edges of the pair of electrodes are disposed between the inner edges of the pair of longitudinal biasing layers.

In a sixth aspect, the present invention provides a magnetoresistance effect device comprising a spin valve film and a pair of electrodes for supplying sense current to the spin valve film, in which the spin valve film comprises at least one nonmagnetic spacer layer and at least two magnetic layers as separated by the nonmagnetic spacer layer existing

therebetween. The spin valve film is provided with a magnetoresistance effect-improving layer of being a laminate film of a plurality of metal films as disposed adjacent to the magnetic layer on the plane opposite to the plane at which the nonmagnetic spacer layer is contacted with the magnetic layer, and with a nonmagnetic layer acting as a underlayer or a protecting layer as disposed adjacent to the magnetoresistance effect-improving layer on the plane opposite to the plane at which the magnetic layer is contacted with the magnetoresistance effect-improving layer, and that the element essentially constituting the metal film of the magnetoresistance effect-improving layer that is adjacent to the magnetic layer does not form a solid solution with the element essentially constituting the magnetic layer.

In the above described element, the magnetoresistance effect-improving layer may exhibit, as its one capability as follows. In the device in which the free layer is thin, the magnetoresistance effect-improving layer acts as a nonmagnetic high-conductivity layer such as that mentioned above. In this, the interface between the ultra-thin free layer and the nonmagnetic high-conductivity layer is formed of a combination of materials not producing a solid solution therein, thereby preventing any diffusive scattering of electrons in the interface so as to improve the up-spin transmittance. With that constitution, the device maintains

high MR ratio therein. As not having a solid solution phase, the interface is stable to thermal treatment and does not cause the reduction in MR ratio in the device. The magnetoresistance effect-improving layer exhibits its ability to improve the magnetoresistance effect of the device, while being based not only on its spin filter capability but also on its additional capabilities to control the microcrystal structure of the spin valve film and to reduce the magnetostriction in the film.

In one specific example, the magnetic layer adjacent to the magnetoresistance effect-improving layer may be made of Co or a Co alloy, the magnetoresistance effect-improving layer may comprise at least one element selected from Cu, Au and Ag. In another example of the device where the magnetic layer adjacent to the magnetoresistance effect-improving layer may be made of an Ni alloy, the magnetoresistance effect-improving layer may comprise at least one element selected from Ru, Ag, Cu, and Au. In the device, the magnetoresistance effect-improving layer may comprise any one or more elements of Cu, Au, Ag, Pt, Rh, Ru, Al, Ti, Zn, Hf, Pd, Ir, etc.

The magnetoresistance effect device of the invention is based on the technique of reducing the magnetostriction in the CoFe alloys and others noted above by or Au/Cu laminate film, Ru/Cu laminate film, or Au-Cu alloys. Specifically, the device comprises a spin valve film and a pair of electrodes